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(54) Abstract Title
Friction clutch

(57) A friction clutch is composed of a flywheel (2) driven by the crankshaft of a motor vehicle and a casing (3) fixed onto the flywheel (2). A pressure plate (5) is disposed in the casing (3) and is rotatable therewith. The pressure plate (5) is axially moveable in the casing (3) under the influence of a diaphragm spring (4) operated by a release mechanism to compress external friction discs (12) supported on the casing (3) and an internal disc (8) against the flywheel (2). The internal disc (8) is fitted with toothing (9, 11) onto a hub (14) which drives a gearing input shaft. There is axial play in the toothing (9, 11) and this axial play is influenced by plastics material introduced on assembly of the motor, the clutch and the gearing so the hub (14) is displaced within the axial play into the position located closest to the flywheel (2).

Fig.1

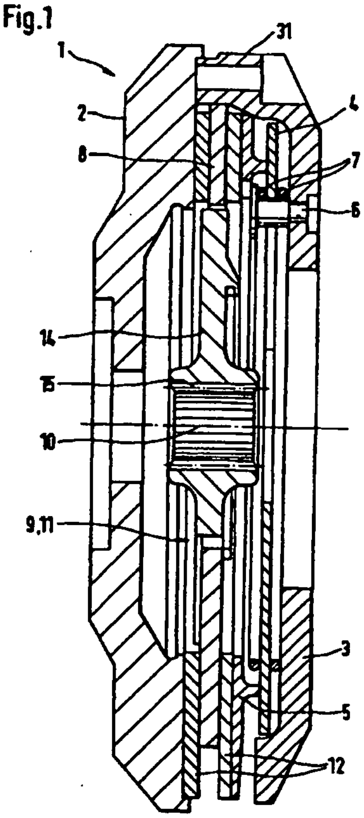

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Fig.1

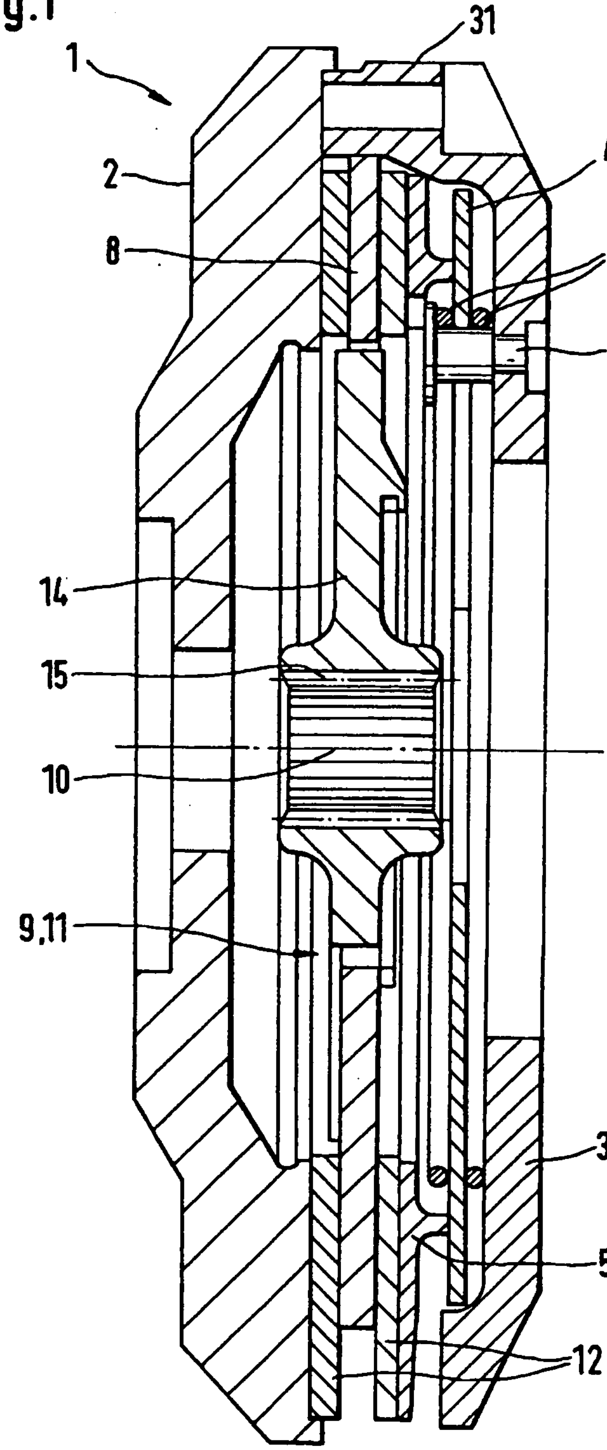


Fig.2

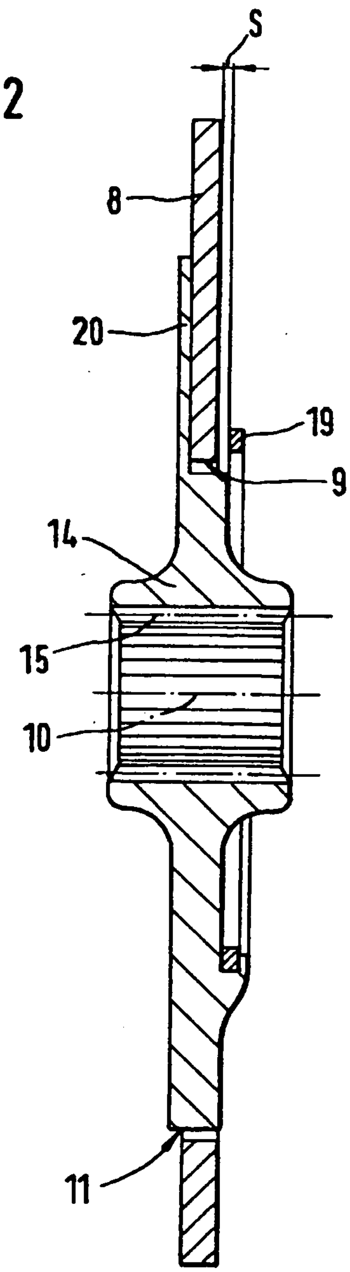
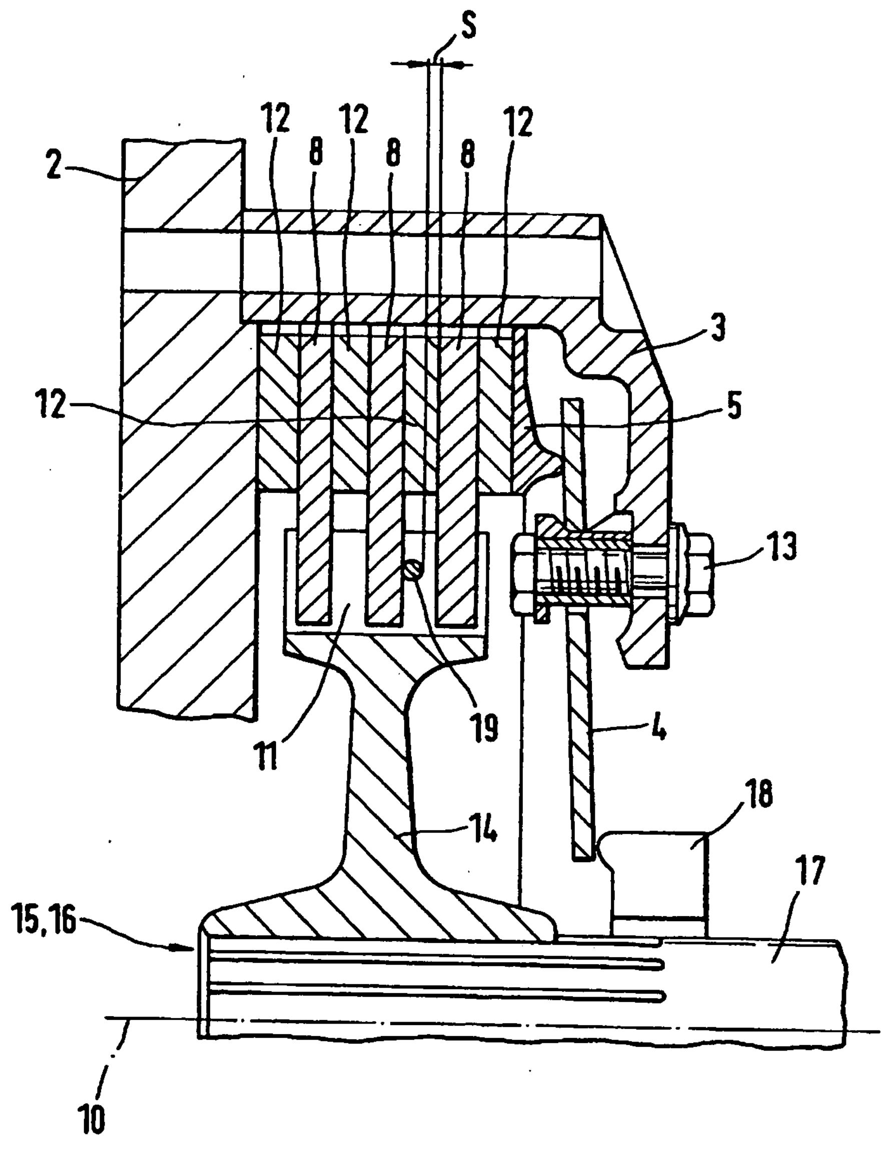


Fig.3



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Friction clutch

The invention relates to a friction clutch.

It is already known from German Offenlegungsschrift 43 24 203 to provide a friction clutch with a clutch disc composed of a disc non-rotatably connected to a hub by toothing. These two parts are fixed to one another in the axial direction but some axial play is provided between the two parts.

It is also known from US Patent 5,301,779 to guide a plurality of discs non-rotatably on the hub in a multiple-disc clutch. Securing means extending axially between two adjacent internal discs are provided to secure the hub axially therein. Axial play between the securing means and the discs is also provided in this case. This play is also required, for example, with respect to wear of the individual discs.

In practice, it has been found that, in particular in the case of vehicles used for sporting events, irregular transmission of force can occur during the starting procedure due to the fact that the hub can adopt different axial positions at the beginning of torque transmission, that is during the clutch engagement procedure, to the extent of the play between the securing means and the corresponding stops. If the hub adopts a position remote from the flywheel during the starting procedure, the hub has to be shifted axially on the gear shaft during the engagement procedure, more specifically in the direction of the flywheel. As the torque transmission increases, this axial displacement demands an increasingly greater force and can sometimes be carried out jerkily. This adversely affects the transmission of torque from the motor to the gearing during the starting procedure.

It is an object of the present invention to provide an improved friction clutch which influence the axial position of the hub within constructionally predetermined axial play.

According to the invention, there is provided a friction clutch for use in the power train of a motor vehicle, and in particular a racing clutch, comprising

a flywheel for arranging on the crankshaft of an internal combustion engine, a clutch casing fixed to the flywheel, a pressure plate which is non-rotatable but axially movable in the clutch casing, at least one disc which can be clamped between the pressure plate and the flywheel, a hub for non-rotatable but axially movable fitment to a gearing input shaft and teeth between the at least one disc and the hub to produce a connection which is non-rotatable but slack to an axially limited extent between the at least one disc and the hub, wherein predetermined axial play is provided in the teeth between the at least one internal disc and the hub and means is provided to shift the hub within the axial play into the position located closest to the flywheel during assembly of a motor, the friction clutch and the gearing.

This ensures that no further displacement of the hub toward the flywheel has to be carried out during the engagement procedure - even if wear can occur on the disc or discs in this case. As a result, no resistance which could adversely affect the engagement procedure is expected from the hub.

The hub itself can have internal teeth engaged on external teeth of the gearing input shaft.

The means can consists of a plastics material which is arranged in the region between the internal teeth and the external teeth.

This plastics material within the teeth ensures that the gear shaft has to be introduced with increased force into the internal teeth of the hub during assembly of the motor, the friction clutch and the gearing. As a result, the hub moves as far as its axial mobility allows in the direction of the flywheel. It is assumed that the friction clutch is located in the closed state at least during the last range of this axial displacement during assembly.

Preferably the plastics material is so designed that the melting point is attained or exceeded at the latest at operating temperatures of the hub and/or the gearing input shaft. Owing to this adaptation of the plastics material, the plastics material can be influenced during operation of the friction clutch in its resistance to axial displacement such that the axial displaceability is completely regained during operation of the friction clutch. This ensures that the engagement procedure as well as the disengagement procedure can be carried out without obstruction during the subsequent shift procedures. The plastics material is preferably so designed that, even after a racing starting procedure, the temperature then occurring in the region of the teeth causes the plastics material to flow.

The plastics material can be applied to the internal teeth of the hub and/or the external teeth of the gearing input shaft. It is thus possible that the application of the plastics material to one of the two parts, hub or gearing input shaft, is quite adequate.

The plastics material can advantageously be sprayed onto the corresponding component. However, it is also conceivable for the gear shaft, for example, to be provided with a corresponding coating by immersion in plastics material.

The invention may be understood more readily, and various other aspects and features of the invention may become apparent, from consideration of the following description.

Embodiments of the invention will now be described in more detail hereinafter by way of examples only and with reference to the accompanying drawings, in which

Figure 1 is a longitudinal section through a friction clutch constructed in accordance with the invention;

Figure 2 is a separate view of the clutch disc of the friction clutch shown in Figure 1 and

Figure 3 is a longitudinal section of the upper half of another friction clutch constructed in accordance with the invention.

As shown in Figure 1, a friction clutch 1 comprises a flywheel 2 which is intended to be arranged on a crankshaft of an internal combustion engine (not shown). A clutch housing or casing 3 is fixed on the flywheel 2, and in the clutch casing 3 there is arranged a pressure plate 5 which is rotationally engaged with the clutch casing 3 but is guided axially movably relative thereto. This guidance can be effected, for example, via tangential leaf springs but also via axially extending contact edges between the pressure plate 5 and clutch casing 3. Axially between the pressure plate 5 and the clutch casing 3 is arranged a diaphragm spring 4 which rests via wire rings 7 and via a plurality of peripherally distributed spacer bolts 6 on the clutch casing 3 and is able to exert an axial force on the pressure plate 5 with its region arranged radially outside the spacer bolts 6 in order to press a clutch disc assembly onto the flywheel 3 for torque transmission. The diaphragm spring 4 is

provided radially inwardly beyond the spacer bolt 6 with spring tongues which cooperate with a release mechanism (not shown).

In the illustrated embodiment, the clutch disc assembly comprises a hub 14 which is non-rotatably connected to an internal disc 8. The connection is produced via teeth 9, 11 which are formed non-rotatably substantially without play and have predetermined play in the axial direction. The hub 14 is supported non-rotatably with internal teeth 15 on a gearing input shaft (not shown). The disc 8 lies between two external discs 12 which are connected non-rotatably and axially displaceably to the clutch casing 3. All parts of the friction clutch 1 are arranged concentrically to an axis of rotation 10 and are able to rotate around the axis 10 together with the crankshaft.

Figure 2 shows the complete clutch disc assembly in detail. This assembly consists of the hub 14 with the internal teeth 15 and external teeth 11 in which the internal disc 8 engages non-rotatably with internal teeth 9. The hub 14 is provided with a peripheral web 20 which represents one of two axial stops for the internal disc 8 which is active in the direction of the flywheel 2. The other axial stop 19 in the opposite direction is so arranged that axial play S is formed between the internal disc 8 and the hub 14. The two axial stops 19 and 20 are designed to prevent the hub 14 from wandering off in one or other direction during operation of the friction clutch. A connection between the internal disc 8 and the hub 14 without axial play is theoretically possible but is not advised for various reasons. On the one hand, it conflicts with the exact production required and on the other hand the lifting behaviour of the clutch is positively influenced by this play.

It has accordingly been found that under certain operating conditions the clutch has irregular torque transmission during the vehicle starting procedure. This is extremely undesirable for the starting procedures in the starting phase of racing cars. The reason for these irregularities is that, before the starting procedure when the first gear is engaged and the clutch is actuated via the actuating system, the axial position of the hub 14 on the gearing input shaft is not defined. The hub 14 is able to move toward the flywheel or away from the flywheel owing to vibrations of the engine in the region of the axial play S relative to the internal disc 8. If the situation at the beginning of the starting procedure corresponds to the illustration in Figure 2, i.e. the axial play S is located between the internal disc 8 and the right-hand axial stop 19, forcible entrainment of the hub 14 toward the flywheel 2 is effected during the engagement procedure even with a minute movement of the internal disc 8 toward the flywheel 2. This entrainment is complicated in that torque is already transmitted via the teeth 15. The hub 14 can accordingly be moved toward the flywheel 2 only with the aid of relatively great engagement forces. However, if the axial play S is between the peripheral web 20 and the internal disc 8, that is on the flywheel side, at the beginning of the starting procedure and therefore of the clutch engagement procedure, the starting procedure can be carried out without problems as the engagement movement which the pressure plate 5 and the internal disc 8 perform toward the flywheel 2 can be performed without simultaneous axial displacement of the hub 14. It should be noted that the axial displacement between the internal disc 8 with its internal teeth 9 is subjected to smaller peripheral forces on the external teeth 11 of the hub 14 as this position is at a greater distance from the axis of rotation 10 than the teeth 15, 16.

Figure 3 shows a longitudinal section through the upper half of a multiple-disc clutch in which a plurality of external discs 12 and a plurality of internal discs 8 are provided. The normal design of this clutch is identical to that shown in Figure 1 with regard to the mode of operation. Multiple-disc clutches in which the internal discs and the external discs consist of carbon material are used, in particular, in racing vehicles. The clutch comprises a flywheel 2 on which the clutch casing 3 is fastened. The diaphragm spring 4 rests on the clutch casing 3 via a plurality of peripherally distributed screw bolts 13. In the engaged state, the diaphragm spring 4 acts with its biasing force via the pressure plate 15 on the discs 8, 12 and clamps them together against the flywheel 2. The internal discs 8 are therefore connected non-rotatably but axially displaceably to the hub 14 in that they comprise internal teeth which engage in corresponding external teeth 11 in the hub 14. The hub itself is placed with internal teeth 15 on the external teeth 16 of the gearing input shaft 17. A release means 18 capable of acting on the radially inwardly directed tongues of the diaphragm spring 4 is also shown schematically. In the present case, an axial stop 19 which is arranged between the first and the second internal disc 8, as viewed from the diaphragm spring 4, is provided to secure the hub 14 axially relative to the internal discs 8. As a condition for a good starting procedure, the axial play S is arranged between the axial stop 19 and the first internal disc 8, as viewed from the diaphragm spring 4. The clutch is lifted by the release means 18 in that the radial internal region of the diaphragm spring 4 is moved toward the flywheel 2 so that the radially outer region of the diaphragm spring 4 lifts from the pressure plate 5 and all discs 8, 12 can be lifted. If an engagement procedure is now initiated and the hub 14 is held in the position shown in Figure 3, a perfect starting procedure can be performed because, during the engagement procedure, the engagement movement of the discs 8, 12 toward the flywheel 2 is

not impeded by a necessary axial displacement of the hub 14. The displacement in the teeth 11 is easier to perform as there is a significantly greater distance from the axis of rotation 10 here.

In the friction clutches according to Figures 1 to 3, plastics material is introduced between the teeth 16 of the gearing input shaft 17 and the internal teeth 15 of the hub 14 to ensure that the hub 14 is held in its position close to the flywheel 2 on assembly of the motor, the clutch and the gearing, the first time the clutch is put into operation. When the gear shaft 17 is introduced into the internal teeth 15 of the hub 14, a corresponding axial force is exerted on the hub 14 by the plastics material. The hub 14 is held in this position close to the flywheel 2 during the first actuation or during the first actuations of the friction clutch. By adapting the plastics material to the operating heat in the region of the hub 14 or of the gearing input shaft 17, the flowability of the plastics material can be utilised to reduce the axial force between the gear input shaft 17 and the hub 14 at the earliest after the first racing engagement procedure to such an extent that the clutch can be actuated normally during the shift procedures. The requirements of the engagement procedure after a shift procedure are considerably smaller than the requirements at the first racing start.

Claims

1. A friction clutch for use in the power train of a motor vehicle, in particular a racing clutch, comprising

a flywheel (2) for arranging on the crankshaft of an internal combustion engine,

a clutch casing (3) fixed to the flywheel,

a pressure plate (5) which is non-rotatable but axially movable in the clutch casing,

at least one disc (8) which can be clamped between the pressure plate and the flywheel,

a hub (14) for non-rotatable but axially movable fitment to a gearing input shaft and

teeth (9, 11) between the at least one disc (8) and the hub (14) to produce a connection which is non-rotatable but slack to an axially limited extent between the at least one disc (8) and the hub (14),

wherein predetermined axial play (S) is provided in the teeth (9, 11) between the at least one internal disc (8) and the hub (14) and means is provided to shift the hub (14) within the axial play (S) into the position located closest to the flywheel (2) during assembly of a motor, the friction clutch and the gearing associated with the input shaft.

2. A friction clutch according to Claim 1, wherein the hub (14) has internal teeth (15) placed on external teeth of the gearing input shaft and the shifting means consists of plastics material

arranged in the region between the internal teeth (15) and the external teeth (16) of the hub (14) and the disc (8).

3. A friction clutch according to Claim 2, wherein the plastics material is so designed that the melting point is attained or exceeded at the latest at the operating temperature of the hub (14) and/or the gearing input shaft (17).

4. A friction clutch according to Claim 2 or 3, wherein the plastics material is applied to the internal teeth (15) of the hub (14) and/or the external teeth (16) of the gearing input shaft (17).

5. A friction clutch according to Claim 4, wherein the plastics material is sprayed on.

6. A friction clutch according to any one of claims 1 to 5, wherein a number of discs (8) are provided.

7. A friction clutch substantially as described with reference to, and as illustrated in, Figures 1 and 2 or Figure 3 of the accompanying drawings.

Application No:	GB 9905521.2	**Examiner:**	James Porter
Claims searched:	All	**Date of search:**	29 October 1999

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): F2C (C1C9A1, C1C9A2)

Int Cl (Ed.6): F16D 13/64

Other: Online databases: WPI, EPODOC, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	GB2301156 A (FICHTEL & SACHS)	-
A	EP0764793 A1 (VALEO)	-
A	WO91/14878 A1 (AUTOMOTIVE PRODUCTS)	-

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.